

Anticoccidial effects of dietary *Vernonia amygdalina* leaf meal in broiler chicken production

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Abstract

This experiment was conducted to evaluate the effects of varying levels of *Vernonia amygdalina* leaf meal as anticoccidial in broiler chickens. A total of one hundred and fifty day old marshal broiler chicks were randomly allotted to five dietary treatments with 30 birds per treatment and replicated three times in a completely randomized design for a period of eight weeks. The treatments were: T1 naturally infected and treated with Coccidiostat drug (positive control), T2 naturally infected and not treated with *Vernonia amygdalina* (negative control), T3, T4 and T5 were naturally infected and treated with *Vernonia amygdalina* at 0.2%, 0.4% and 0.6% to 100kg of feed, respectively. Carcass and organ parameters were monitored while the liver and caecum were assessed for histopathological lesions. Significant differences ($p < 0.05$) were observed in all carcass parameters except drum stick, leg and neck weight. The dressed percentage ranged from 66.47%-70.98%. T2 had the highest value of live weight of **1591.17g** and T5 had the lowest value. T3 had the highest percentage for plucked weight (**90.29%**), eviscerated weight (**76.79%**) and dressed weight (70.69%) while highest thigh (**10.28%**), head (**3.12%**), liver (**2.45%**) and gizzard weights (**2.52%**) were obtained in T1. Histopathological result show that T4 was the best compared to T2. However, hepatocytes and lymphocytes were best produced at 400g inclusion level of *Vernonia amygdalina* in the diet. Inclusion of *Vernonia amygdalina* at 400g/100kg is safe and effective in combating the effect of coccidiosis in broiler without any significant detrimental effect on the organs of broiler chicken but cause a reduction in growth performance.

Keywords: Histopathological, carcass, *Vernonia amygdalina*, anticoccidial, hepatocytes

Introduction

Over the years, one of the main challenges in poultry production is coccidiosis, an internal parasite causing death and losses of about 20 percent or more (Chauhan *et al.*, 2007). Coccidiosis plays an inhibitory role in the growth of poultry industry and it is caused by different species of *Eimeria* which inflict the birds in both clinical and sub-clinical forms. The clinical form of the disease manifests through prominent signs like bloody faeces, diarrhea, morbidity and mortality. Avian coccidiosis is a complex intestinal disease caused by protozoan

parasites belonging to genus *Eimeria*. Anticoccidial drugs over a long time may lead to emergence of drug resistant population of coccidia. It is therefore important to review or change the medicine used as coccidiostat from time to time. Use of restricted feeding may also result in less than optimum dose of coccidiostat (Shirly 1992). Over time, chemoprophylaxis and anticoccidial feed additives have been used to control the disease but the situation has been complicated by the emergence of drug resistance (Abbas *et al.*, 2011) and their potentially toxic effects on animal and

human health (Nogueira *et al.*, 2009). Another approach for coccidiosis control is the vaccination of birds with live *Eimeria* oocysts, but in cases of poor management, these live vaccines can trigger severe reactions that may affect the performance of the flocks, mainly in broiler chickens because of their rearing period (Chapman, 2000).

Vernonia amygdalina (VA) is a shrub or small tree that grows throughout tropical Africa. It is popularly called bitter leaf because of its abundant bitter taste (Ekpo *et al.*, 2007). The leaves contain a considerable amount of anti-nutritional factors like high level of tannic acid and Saponin (Charles and Boulevard, 2012). The findings by Akwaowo *et al.* (2000) reported that the young leaves often preferred for human consumption contain high cyanide ($60.1\text{mg } 100^{-1}\text{g DM}$) and tannin content ($40.6\text{mg } 100^{-8}\text{ DM}$) than older ones. Furthermore, *Vernonia amygdalina* has also been used as feed for broiler chickens, where it was able to replace $300\text{g kg}^{-1}\text{DM}$ of maize based diet efficiently (Bonsi *et al.*, 1995). Research has shown that *Vernonia amygdalina* have some beneficial effect in disease management of poultry (Dakpogan, 2006). It has anti-bacterial, anti-parasitic and anti-oxidant properties (Erasto *et al.*, 2009) and acts as growth promoter by enhancing the gastro intestinal enzymes thus increasing feed conversion efficiency (Olabatoke and Oloniruba, 2009). As a result of the drawback of live vaccines, attenuated vaccines (with reduced pathogenicity) have been developed, but these are expensive to produce. Cost effective alternative strategies are being sought for more effective and safer control of avian coccidiosis (Abbas *et al.*, 2011). Hence, the need to search for alternative source from medicinal plant as *Vernonia amygdalina* that is cheaper and safer to consume without any detrimental effect on both animal and human.

Material and methods

Experimental site

The experiment was carried out at the poultry unit of Federal College of Animal Health and Production Technology, Moor plantation, Bora Ibadan, Nigeria.

Collection and preparation of plant sample

The plant material, Bitter leaf (*Vernonia amygdalina*) was harvested around the premises of Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan. The Bitter leaf was air dried under shade, packed, milled into powdery form and stored inside an air tight container at room temperature.

Experimental birds and their management

A total number of one hundred and fifty, one day old marshal broiler chicks were purchased from a reputable hatchery in Ibadan. Initial weights of the birds were taken with the use of sensitive weighing scale before they were transferred into well disinfected brooding house. Experimental feed and clean cool water were provided *ad-libitum* throughout the eight weeks of the experiment. Vaccines and medication were administered as at when due except that anti - Coccidiostat were not given.

Infection on experimental birds

Litters were obtained from a farm which had outbreak of coccidiosis. The litter was packed and samples taken to the laboratory to confirm the presence of *Eimeria* oocysts through faecal parasite screening. Screening was done with the use of sodium chloride by flotation method, (John, 2000). When coccidiosis infection was confirmed equal quantity of litter were evenly broadcasted on the floor in each replicate as bedding which lasted for a week and later packed when the birds started manifesting signs and symptoms of coccidiosis.

Experimental diets

The experiment was designed in a completely randomized design (CRD). A

total of one hundred and fifty day old broiler chicks were allotted into five treatments, each treatment had three replicates and each replicate had ten birds making a total of 30 birds per treatment. T1 which served as positive control naturally infected and treated with Coccidiostat (Embazine fort).

T2 was the negative control. They were also naturally infected but not treated with Coccidiostat (Embazine fort) nor *Vernonia amygdalina* (bitter leaf) meal, while T3, T4, T5 were also naturally infected and treated with *Vernonia amygdalina* (bitter leaf) meal at 0.2%g/100kg, 0.4%g/100kg and 0.6g/100kg of feed.

Table 1: Gross Composition of experimental broiler starter diet fed varying level of *Vernonia amygdalina*

Ingredient (kg)	T1	T2	T3 (0.2%)	T4 (0.4%)	T5 (0.6%)
Maize	50.00	50.00	49.80	49.60	49.40
<i>V. amygdalina</i>	-----	-----	0.20	0.40	0.60
Soyabean meal	30.00	30.00	30.00	30.00	30.00
Wheat offal	11.00	11.00	11.00	11.00	11.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	4.50	4.50	4.50	4.50	4.50
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Salt	0.30	0.30	0.30	0.30	0.30
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	22.86	22.86	22.84	22.82	22.80
Crude fiber (%)	4.00	4.00	4.00	4.00	4.00
Ether extract (%)	4.00	4.00	4.00	4.00	4.00
Metabolizable Energy(kcal/kg)	2847.10	2847.10	2840.23	2833.36	2826.49

Table 2: Gross Composition of experimental broiler finisher diet fed varying level of *Vernonia amygdalina*

Ingredient (kg)	T1	T2	T3 (0.2%)	T4 (0.4%)	T5 (0.6%)
Maize	55.88	55.88	55.68	55.48	55.28
<i>V. amygdalina</i>	-----	-----	0.20	0.40	0.60
Soyabean meal	24.42	24.42	24.42	24.42	24.42
Wheat offal	13.00	13.00	13.00	13.00	13.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	20.52	20.52	20.50	20.48	20.46
Crude fiber (%)	4.00	4.00	4.00	4.00	4.00
Ether extract (%)	4.00	4.00	4.00	4.00	4.00
Metabolizable Energy(kcal/kg)	2899.00	2899.00	2894.44	2892.44	2885.44

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Data collection

Determination of coccidia infection

At day 10 of post infection, five grams of faecal sample were randomly collected along the five treatments (T1, T2, T3, T4, and T5) and each was placed inside a universal bottle and then taken to the laboratory to determine the presence of oocysts through faecal parasite screening, with the use of sodium chloride using flotation method according to John (2000).

Carcass evaluation

At the end of the experiment, the birds were fasted overnight; two birds were randomly selected from each replicate and weighed the following morning prior to slaughtering. The live, plucked, eviscerated, dressed, breast, thigh, drumstick, leg, head and neck weights were

taken. Organs measured were gizzard, liver and the heart.

Statistical analysis

Data were subjected to analysis of variance (ANOVA) according to the procedure of SAS (2003). Significant differences between the treatment means were separated using Duncan multiple range test.

Results and discussion

Table 3 Shows the Qualitative and Quantitative determination of the phytochemical constituents of *Vernonia amygdalina*. The result showed the presence of Tannin (0.422), Phenol (0.316), Alkaloid (0.425), Saponin (0.573), Flavonoids (0.483), Terpenes (0.212), Steroid (0.174), Phytate (0.366), Oxalate (0.244), Cyanide (0.134) in *Vernonia amygdalina* (Bitter leaf).

Table 3: Phytochemical Constituent of *Vernonia amygdalina* (Bitter leaf)

Parameters Determined	Qualitative	Quantitative Mean
Tannin (mg /100g)	++	0.422
Phenol (mg/100g)	++	0.316
Alkaloid(mg/100g)	+++	0.425
Saponin (mg/100g)	+++	0.573
Flavonoids (mg/100g)	+++	0.483
Terpenes (mg/100g)	+	0.212
Steroid (mg/100g)	++	0.174
Phytate(mg/100g)	++	0.366
Oxalate(mg/100g)	++	0.244
Cyanide (mg/100g)	+++	0.134

Key

+ = Positive

++ = Moderately Positive

+++ = Strongly Positive

Table 4 shows the carcass characteristics of broiler fed varying levels of *Vernonia amygdalina* leaf meal based diet. The results revealed significant differences ($p < 0.05$) in all the carcass parameters, except the drum stick, leg and neck weight of the chicken. However, chicken infected but not treated with *Vernonia amygdalina* had the highest values of live weight (1591.17) and Breast percentage (21.48),

while chicken infected and treated with 0.2% of *Vernonia amygdalina* had the highest percentage for plucked weight (90.29%), eviscerated weight (76.79%) and dressed weight (70.69%). Highest thigh weight (10.28%), head weight (3.12%) and liver weight (2.45%) was obtained from chicken infected and treated with Coccidiostat, while chicken infected and treated with 0.2% of *Vernonia amygdalina*

recorded highest value of heart weight (0.68%). Highest percentage value of gizzard (2.52%) was obtained in those infected and treated with Coccidiostat. This

might be attributed to antinutritional or toxic compounds present in the leaf meals. The removal of these compounds can help to improve the nutritional component of the leaf meal (Essiest and Solomon, 2013).

Table 4: Carcass Characteristics of broiler chickens fed varying levels of *Vernonia amygdalina* based diet

Parameter (%)	T1	T2	T3 (200g)	T4 (400g)	T5 (600g)	SEM(±)
Live weight(g)	1498.67 ^{ab}	1591.17 ^a	1491.33 ^{ab}	1343.83 ^b	1196.83 ^c	39.36
Plucked %	90.26 ^{ab}	89.18 ^a	90.29 ^{ab}	89.04 ^b	88.14 ^c	36.29
Eviscerated %	74.49 ^{ab}	76.08 ^a	76.79 ^{ab}	74.59 ^b	72.12 ^c	31.99
Dressed %	69.44 ^{ab}	70.69 ^a	70.98 ^{ab}	68.56 ^b	66.47 ^c	30.80
Breast %	18.63 ^{ab}	21.48 ^a	20.54 ^a	20.29 ^{ab}	18.53 ^b	11.76
Thigh %	10.58 ^{ab}	10.28 ^a	10.41 ^{ab}	10.48 ^{ab}	11.07 ^b	4.43
Drum stick %	5.33	4.85	5.15	4.82	5.47	2.29
Leg %	5.47	5.21	5.32	5.43	5.74	2.15
Neck %	3.44	3.26	4.01	4.27	4.53	2.23
Head %	3.14 ^{ab}	3.12 ^a	2.98 ^{ab}	3.16 ^{ab}	3.12 ^b	1.56
Organs weight						
Gizzard %	2.52 ^a	2.34 ^a	2.10 ^{ab}	2.08 ^b	2.06 ^b	1.34
Liver %	2.45 ^a	1.92 ^{ab}	2.36 ^{ab}	2.08 ^{ab}	2.35 ^b	8.50
Heart %	0.57 ^{ab}	0.59 ^{ab}	0.68 ^a	0.53 ^b	0.61 ^b	0.41

a ,b ,c, means of different superscript along the same row are significantly different (p<0.05)
SEM=Standard Error of Means.

Histopathology of liver and caecal broiler chicken fed graded level of *vernonia amygdalina* leaf meal is shown in Plate 1.

No visible lesion was found in the liver of T1. The caecal tonsils showed closely packed lymphocytes which indicate the absence of coccidiosis in the organ of the birds.

For T2 no visible lesion was found in the liver of the birds but there is depletion in the lymphoid of the caeca. This observation supports the findings of Chioma (2017) who observed hepatic alteration in liver of broiler chickens fed varying level of *Cymbopogon citratus* leaf meal as mycotoxin binder. The difference in this study may be attributed to the different targeted organs.

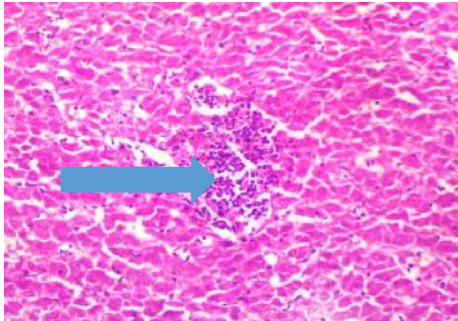
There was a widespread moderate dissociation of hepatic plates of the liver in

T3 and reduction in the size of the caecal with lymphotic necrosis. This might be due to effect of the leaf meal in the caeca. T4 hepatocytes appeared slightly flattened in the liver. The lymphoid tissue in the caecal contains numerous follicles with closely packed lymphocytes. This might suggest intense lymphoid proliferation as the main organ of target of coccidiosis is the caecal. This support the findings of Chioma (2017) who observed lymphoid depletion of the bursa of fabricius especially at the follicle centre of bursa of fibricus in broiler chicken fed *Cymbopogon citratus* leaf meal.

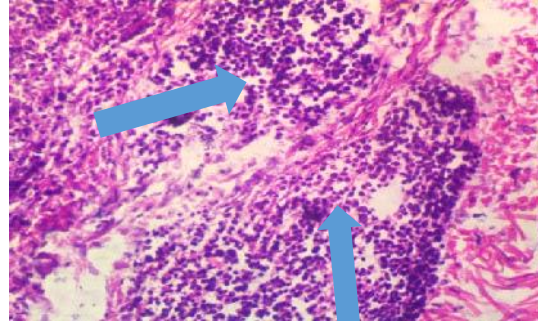
For T5 no visible lesion was found in the liver. The lymphoid tissue in the caecal is very small and not prominent. This observation suggests a lack lymphoid stimulating cell which might be attributed to the nutrient binding compounds in the leaf meal.

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Histopathology of liver and caecal of Broiler chicken fed graded level of *Vernonia amygdalina* coccidiostat

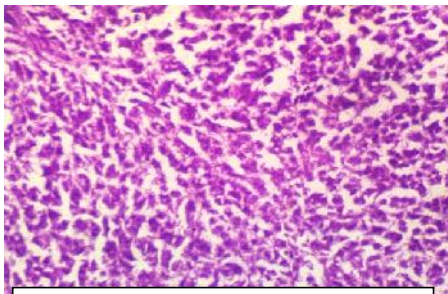


T1, Liver: Hepatocytes show no visible lesion. (arrow) (400X)



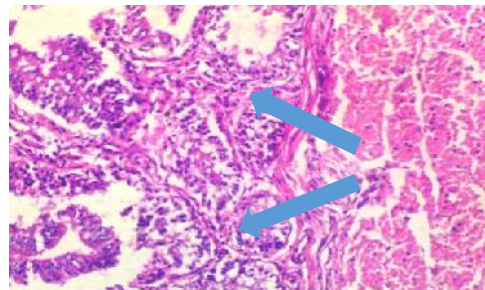
T1, Caecal tonsils: The lymphoid is prominent and contains follicles of closely packed lymphocytes (arrow)

Tissue/ tonsil: There are no aggregates of mononuclear cells

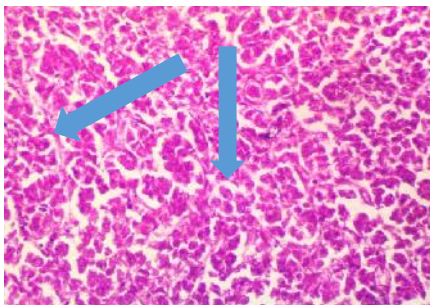


T2, Liver: Poor section (artifact of fixation) evident.

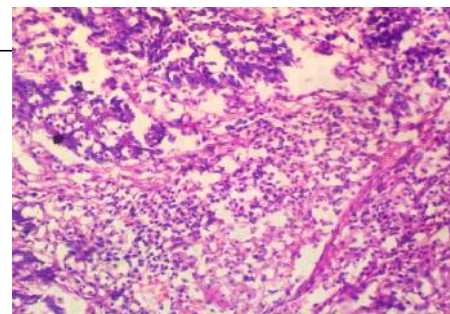
No visible lesion [400X]



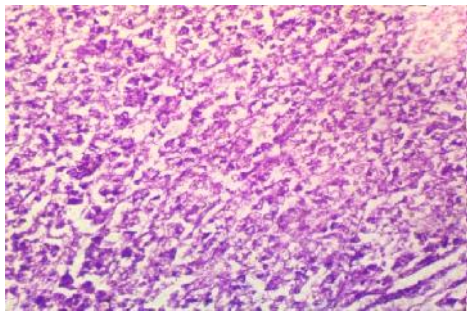
T2, Caecal tonsil: The lymphoid tissue is almost absent, few remnants (arrow) show marked lymphoid depletion.[400X]



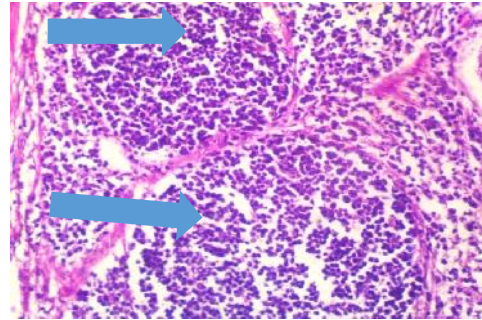
T3, Liver: There is wide spread dissociation of hepatic plates (arrow) [400].



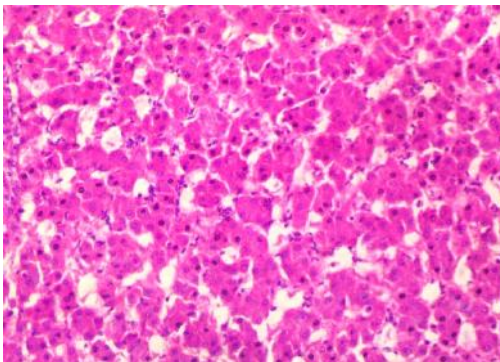
T3, Caecal tonsil: Reduced in size of mostly loosely packed small lymphocytes (arrows) as well as lymphocytic necrosis. Findings are indicative of significant lymphoid depletion [400X]



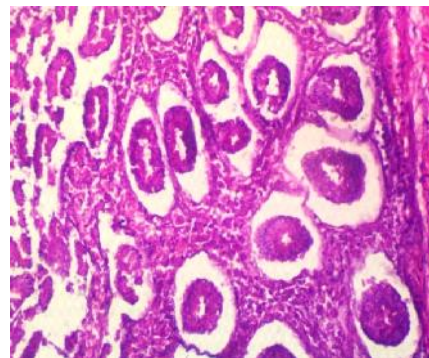
T4, liver: Hepatocytes appeared slightly prominent flattened. [400X] (arrows)



T4, Ceacal tonsils: The lymphoid tissue is prominent and contains numerous follicles (arrows) with closely packed lymphocytes [400X]



T5, liver: No visible lesion [400X]



T5, Caecal tonsils: The lymphoid tissue is very small and not prominent findings might suggest a lack of stimulate, or majority of the tonsils are absent from the section [400X]

Conclusion

Vernonia amygdalina can be used as growth promoters up to 0.2%/100kg and can be used up to 0.4%/100kg of feed to control coccidiosis.

References

- Abbas, R. Z., Manzoor, Z., Munawar, S. H., Iqbal, Z., Khan, M. N., Saleemi, M. K., Zia, M. A. and Yousaf, A. 2011. Anticoccidial activity of hydrochloric acid (HCl) against *Eimeria tenella* in broiler chickens.
- Pesquisa Veterinária Brasileira 31: 425-429.
- Akwaowo, E. U., Ndon, B. A. and Etuk, E. U. 2000. Minerals and anti-nutrients in fluted pumpkin (*Telfairaoccidentalis*). *J. Food Chem.* 70: 235- 240.
- Bonsi, M. L. K., Osuji, P. O., Tuah, A. K. and Umunna, N. N. 1995. *Vernonia amygdalina* as a supplement of teff straw (*Eragrostistef*) fed to Menz sheep. *Agrofor. Syst*; 31:229-241.
- Chapman, H. D. 2000. Practical use of

- vaccines for the control of coccidiosis in the chicken. *World's Poultry Science Journal* 56: 7-20.
- Chauhan, H. V. S. and Roy. S. 2007.** Poultry Diseases Diagnosis and Treatment. Fourth Edition, Published by New Age International Limited, Publishers. New Delhi
- Chioma, G. O. 2017.** Effect of feeding varying dietary levels of *Cymbopogon citratus* and *Andrographis paniculata* leaf meals on the histology of visceral organs of broiler chicken (Unpublished)
- Dakpogan, H. B. 2006.** Free range chick survivability in improved conditions and the effect of 3 medicinal plants on *Eimeria tenella*. M.SC. Thesis, Department of Veterinary Pathology. The Royal Veterinary and Agricultural University, Denmark.
- Essiest, A. G. and Solomon, I. P. 2013.** Growth performance, carcass characteristics, lipid profile and hematological responses of broiler finishers fed with leaf meal derive from Ntong (*Ocimum gratissimum*) and utasi (*Gongronema latifolium*). *IOSR Journal of pharmacology* volume 3, issue 8, pp 01-13
- Ekpo, A., Eseyin, O. A., Ikpeme, A. O. and Edoho, E. J. 2007.** Studies on some biochemical effects of *Vernonia amygdalina* in rats. *Asia J. Biochem.*, 2: 193-197.
- Erasto, P., Grierson, D. S. and Afolayan, A. J. 2009.** Bioactive sesquiterpene lactones from the leaves of *Vernonia amygdalina*. *Ethnopharmacol.* 106: 117-120.
- Olabatoke, R. Y. and Oloniruba, J. A. 2009.** Haematological assessment of bitterleaf (*Vernonia amygdalina*) efficiency in reducing infections in cockerels. Proceedings of the World Congress on Medicinal and Aromatic Plants, November 9-14, Cape Town, South Africa, pp. 472-413.
- John, J. L. 2000.** Illustrated guild to the protozoa, Volume 1, 2 edition. Published by ALLEN PRESS.
- Nogueira, V. A., Franca, T. N. and Peixoto, P. V. 2009.** Ionophore poisoning in animals. *Pesquisa Veterinária Brasileira* 29: 191-197.
- Shirly, M. W. 1992.** Coccidiosis in poultry. *British Vet. Journal* 148: 479

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